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Double Antibiotic Paste for Management of External Inflammatory Root Resorption

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ABSTRACT

External inflammatory root resorption (EIRR) is one of the common complications following dental trauma which when remained untreated, may lead to tooth loss. Successful treatment outcomes depend on elimination of bacteria from root canal system and apical sealing. This case presents the endodontic management of an EIRR that was nonresponsive to calcium hydroxide (CH) therapy. An 11-year-old boy was referred for management of a traumatized maxillary central incisor. Tooth #8 was symptom-free, nonresponsive to vitality pulp tests and had an immature root with sever EIRR. Using chemomechanical debridement and CH dressing, the treatment was initiated. The tooth was remained asymptomatic; however, after five weeks the size of periradicular lesion increased and intracanal exudate was present, signifying a resistant endodontic infection. In second appointment, double antibiotic paste (DAP; ciprofloxacin/metronidazole) was applied to the canal. Eight weeks later, the tooth continued to be asymptomatic and the size of the lesion decreased. Finally, the root canal was entirely obturated with calcium-enriched mixture (CEM). At 18-month follow-up, the tooth was asymptomatic/functional, EIRR did not further progress and tooth discoloration was not observed. Based on the results, DAP has the potential to be used to manage the CH-resistant endodontic infection. Furthermore, CEM root filling/sealing seems to be an applicable choice in EIRR management.

Keywords: Antibiotics; Calcium-Enriched Mixture; CEM Cement; Dental Trauma; Endodontics; Intracanal Medicament; Root Resorption

Introduction

When a tooth is traumatized the damage to pulp and periradicular tissues can possibly occur, which consequently may result in unfavorable tissue responses. External inflammatory root resorption (EIRR), also called infection related root resorption, is one of those unfavorable tissue responses to trauma. Its development requires twofold: an infected root canal system and mechanical damage to cementum or its loss [1]. Cementum loss results in significant increase in dentine permeability, and as a result, bacterial toxins, as inflammatory stimulus, from the infected root canal can readily pass through dentinal tubules and provoke inflammatory response in the periodontal ligament [2]. Wider dentinal tubules make the transmission easier and therefore EIRR can occur faster in younger teeth [3]. The inflammatory response is initiated by an active destructive phase, which lasts as long as the stimulus is present [2]. Moreover, EIRR is rapidly progressing in nature and can eventually lead to tooth loss for as short as few months [4].

The treatment of EIRR primarily includes chemomechanical preparation of the root canal system followed by dressing the canal with calcium hydroxide (CH). This intends to disinfect the root canal system and arrest the resorption process [4]. However, CH is not always effective in eradicating bacteria from root canal space and therefore, there is a need for innovative intracanal medicaments with predictable results. Bearing in mind the polymicrobial nature of root canal infections, various antibiotic combinations have alternatively been suggested. The mixture of ciprofloxacin, metronidazole, and minocycline, known as triple antibiotic paste (TAP), is the most popular inter-appointment

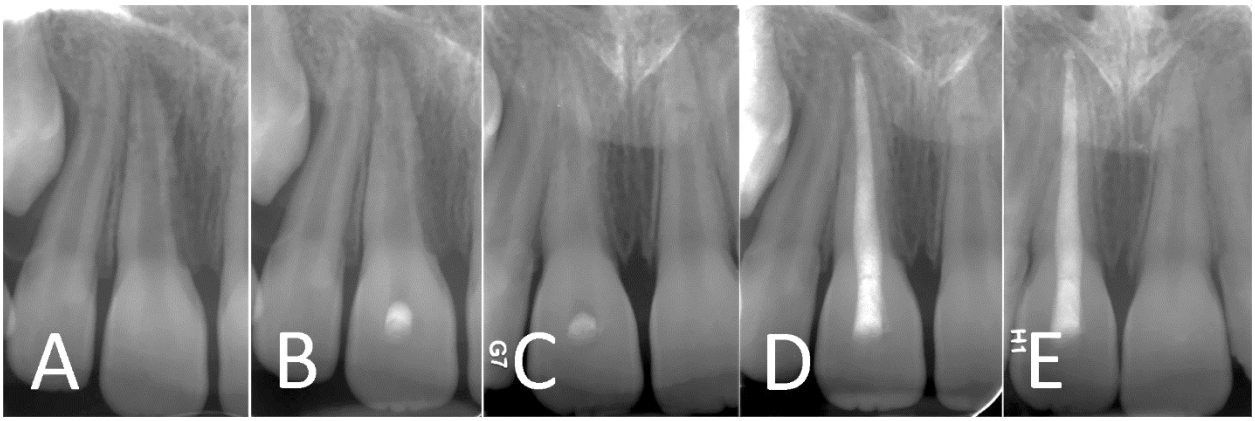

Figure1. *A)* Initial periapical radiograph. Tooth #8 showed immature root with extensive external root resorption on mesial aspect and periradicular radiolucency; *B)* Second appointment, five weeks after initial CH therapy. Note the increased size of periradicular lesion; *C)* Eight weeks after DAP application for treatment of resistant endodontic infection. The size of the lesion was reduced; *D)* Immediate post-obturation radiograph. The canal was filled entirely with CEM cement; *E)* 18-month follow-up radiography showing complete resolution of periradicular radiolucency, intact lamina dura and resorption lacunae filled with new bone.

medicament in endodontic regeneration [5]. Although TAP is believed to be antimicrobial and biocompatible, it induces visible coronal discoloration. Minocycline component was consequently eliminated from the paste to develop double antibiotic paste (DAP) with no visible color changes [6].

Calcium-enriched mixture (CEM) cement is a tooth-colored water-based endodontic biomaterial with several clinical reports concerning its successful application in management of traumatized teeth [3, 7-9]. CEM cement consists of different calcium compounds, demonstrating biocompatibility, favorable sealing ability, low cytotoxicity and antibacterial activity [10-13]. Furthermore, this endodontic biomaterial is able to induce periapical tissue regeneration [14, 15]. All these advantages make CEM cement a promising root canal filling material for managing complex and challenging cases [16].

This case report describes successful management of trauma-induced EIRR non-responsive to CH disinfection, using DAP as intracanal medicament and CEM cement as orthograde obturation material.

Case Report

An 11-year-old boy with history of dental trauma to the maxillary central incisors about 6 months earlier, attended a private dental clinic. The teeth were asymptomatic and intact. After the patient's medical/trauma history was documented and clinical examination was performed. The electric and thermal pulp tests showed normal vital responses on teeth #7, #9 and #10; conversely, tooth #8 was nonresponsive. No signs/symptoms of infection or inflammation were observed on the surrounding tissues of the tooth #8. The tooth mobility was normal and probing depths were within normal limit (<3 mm). Radiographic examination revealed evidence of sever EIRR and associated periradicular lesion of tooth #8 (Figure 1A). The final diagnosis was pulp necrosis associated with EIRR and asymptomatic periradicular periodontitis for tooth #8. Due to the extent of EIRR, multi-visit endodontic treatment was decided to perform for tooth #8 and the other teeth were put on follow-up. This treatment plan and its potential risks were fully explained to patient's parents.

At the same appointment, tooth #8 was anesthetized, isolated and an access cavity was prepared; after working length determination, the canal was chemomechanically disinfected using the full strength NaOCl. Finally, a creamy mixture of CH (Ariadent; AsiaChemiTeb Co., Tehran, Iran) was introduced into the canal using counterclockwise motion of a #35 K-file to the working length and the access cavity was temporarily filled with Cavit (Ariadent; AsiaChemiTeb Co., Tehran, Iran). Five weeks later, the tooth was clinically asymptomatic; however, radiographic evaluation revealed that the size of periradicular lesion increased (Figure 1B). CH dressing was flushed out from the root canal of tooth #8 using a #35 K-file with passive/copious irrigation with sterile saline solution. The root canal did not dry after using absorbent paper points; a moderate amount of exudate was evident. DAP (ciprofloxacin and metronidazole; 1:1 ratio) was then applied to control the persistant infection. Using the Cavit, temporary restoration was placed.

After eight weeks, patient remained clinically symptom-free. Periapical radiograph showed a reduction in the size of the periradicular lesion (Figure 1C). The medicament was removed from the canal using a #35 K-file with copious irrigation. A creamy consistency of CEM cement (BioniqueDent, Tehran, Iran) was prepared and inserted into the dried canal. The cement was then compacted vertically by means of #40 paper cones and appropriate hand pluggers. After complete canal obturation, the

access cavity was permanently restored with Z100 composite resin (3M ESPE, St Paul, MN, USA). Post-treatment radiograph showed that the canal was uniformly filled with CEM cement. Additionally, a slight extrusion of the biomaterial into periapical tissues was evident (Figure 1D).

The patient was recalled up to 18 months after root canal filling. The chosen treatment for tooth #8 was considered successful as EIRR did not further progress, and the tooth was functional and remained clinically asymptomatic at follow-up sessions. In addition, no visible coronal discoloration due to the canal medicament or obturation material was observed. Radiographic findings showed complete healing of the periradicular lesion and an intact lamina dura (Figure 1E). No clinical or radiographic pathosis was observed for teeth #7, #9 and #10.

Discussion

In the present case, after five-week of unsuccessful CH treatment, DAP was preferred for management of the traumatized anterior tooth with sever EIRR, which produced successful outcomes. CH is the most commonly used intracanal dressing in endodontic treatments; the antimicrobial effect of this strongly basic material is related to hydroxyl ion release, which are oxidant-free radicals in an aqueous environment [17]. However, CH is unequally effective against endodontic bacteria found in intracanal biofilms [18]. A Recent report demonstrated the efficacy of TAP in non-responsive cases to CH therapy [19]. Moreover, a recent *in vitro* study demonstrated that DAP and TAP were comparable in their antibacterial activities against *Enterococcus faecalis* and *Porphyromonas gingivalis* [20]. On the other hand, multiple and long-term applications of CH can lead to low compliance and weakening of dental structures, respectively [4]. Currently, there is no reliable evidence regarding the efficacy of various interventions for the treatment of EIRR; therefore, endodontists must decide on the most appropriate means of managing EIRR according to their clinical experience [21].

In our case, following eight weeks of DAP application to treat resistant apical infection, tooth #8 was completely filled using CEM cement due to the extent of root resorption and immaturity of the tooth. Periapical lesion and relevant apical destruction contributed to a slight apical extrusion of CEM cement following canal obturation. However, not only the periapical tissue healing was not disturbed by the extruded cement but also completely achieved, judged by post-treatment radiographs. This positive finding confirms the results of an animal study that showed the ability of CEM cement to induce complete dentoalveolar regeneration when used as a root-end filling material [14].

Based on several case reports, employing revascularization protocol or short periods of intracanal CH/TAP application followed by obturation with endodontic biomaterials releasing CH, *i.e.* mineral trioxide aggregate (MTA) and CEM cement, seems to be a practical solution to manage EIRR [3, 4, 22]. MTA has been used instead of CH for the management of a variety of complications following dental trauma, including EIRR [23]. This biomaterial possess several characteristics desirable in treatment of EIRR, namely, biocompatibility, CH release and high pH, low cytotoxicity, good sealing ability and hard tissue induction [24, 25]. In contrast, limited antibacterial properties and tooth discoloration are major drawbacks with MTA in this context [26, 27]. CEM cement is another endodontic biomaterial with similar clinical applications to MTA; despite differences in chemical composition, CEM cement shows similarities with MTA in sealing ability, pH, cytocompatibility and cementogenic properties [10]. This biomaterial also releases CH during and after its setting [28]. However, CEM is a tooth-colored cement showing antibacterial activity comparable with CH and superior to MTA, which overcomes the aforementioned disadvantages of MTA in EIRR treatment especially in esthetic region [27, 29].

Considering CH release from CEM cement, one important issue about using this endodontic cement as a root filling material is whether CEM cement exerts the same dentine weakening effect as CH. An *in vitro* study reported the distinct strengthening effect of CEM cement on immature teeth after a six-month period [30]. Furthermore, another laboratory study indicated that CEM cement had no adverse long-term influence on dentine strength [31]. In both studies, CEM performed non-significantly better than MTA [30, 31].

Conclusion

From the presented case it can be concluded that DAP has the potential to be used in teeth diagnosed with CH-resistant endodontic infections. Furthermore, CEM root filling/sealing seems to be an applicable choice in management of sever cases of EIRR. However, further clinical studies with large sample sizes and long follow-ups are required to draw definite conclusion.

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Conflict of Interest: 'None declared'.

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